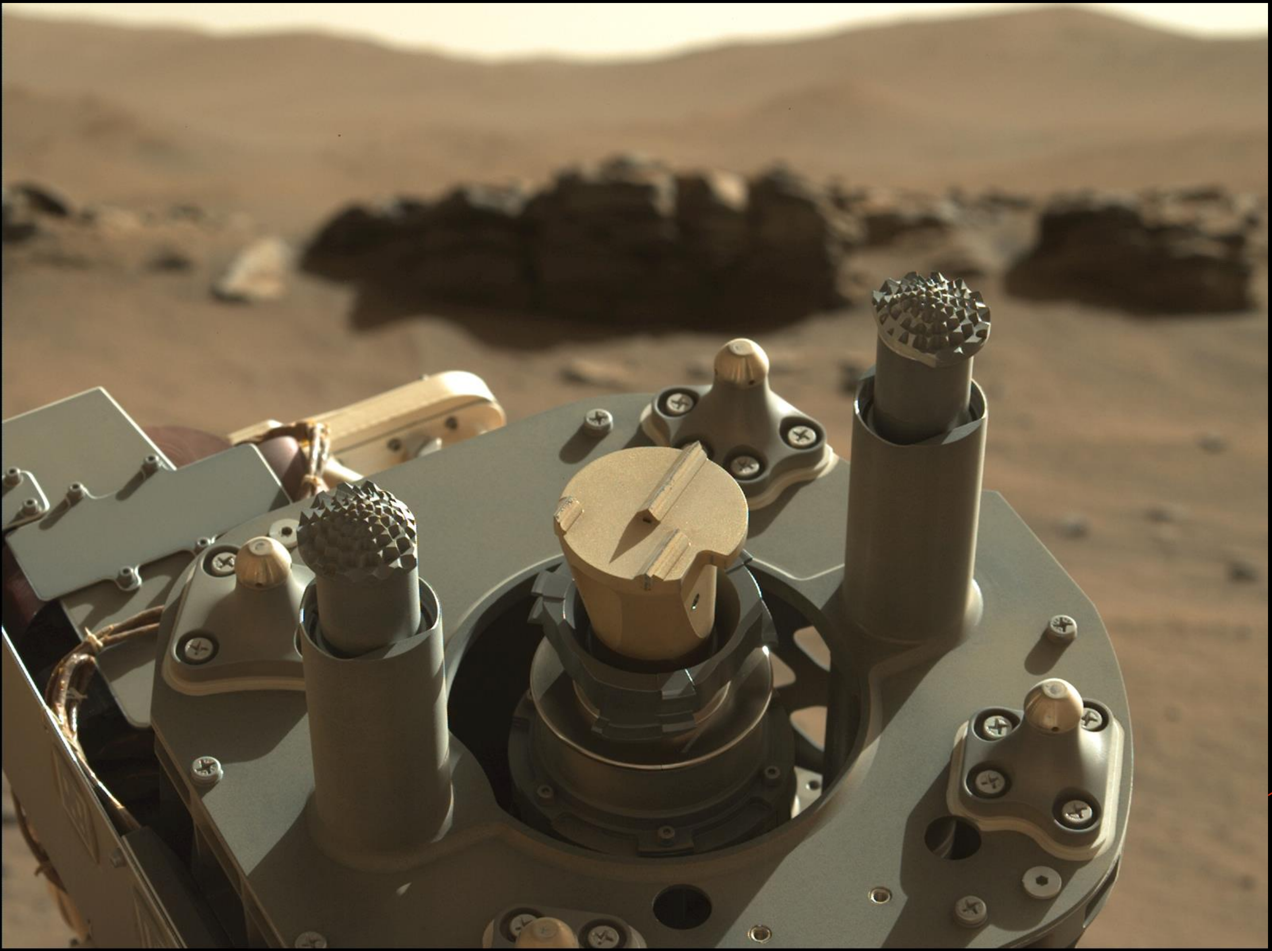

Mars 2020 Perseverance Rover Status

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MEPAG VM #14
February 2, 2022

Jet Propulsion Laboratory
California Institute of Technology

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Government sponsorship acknowledged.

Mission Status

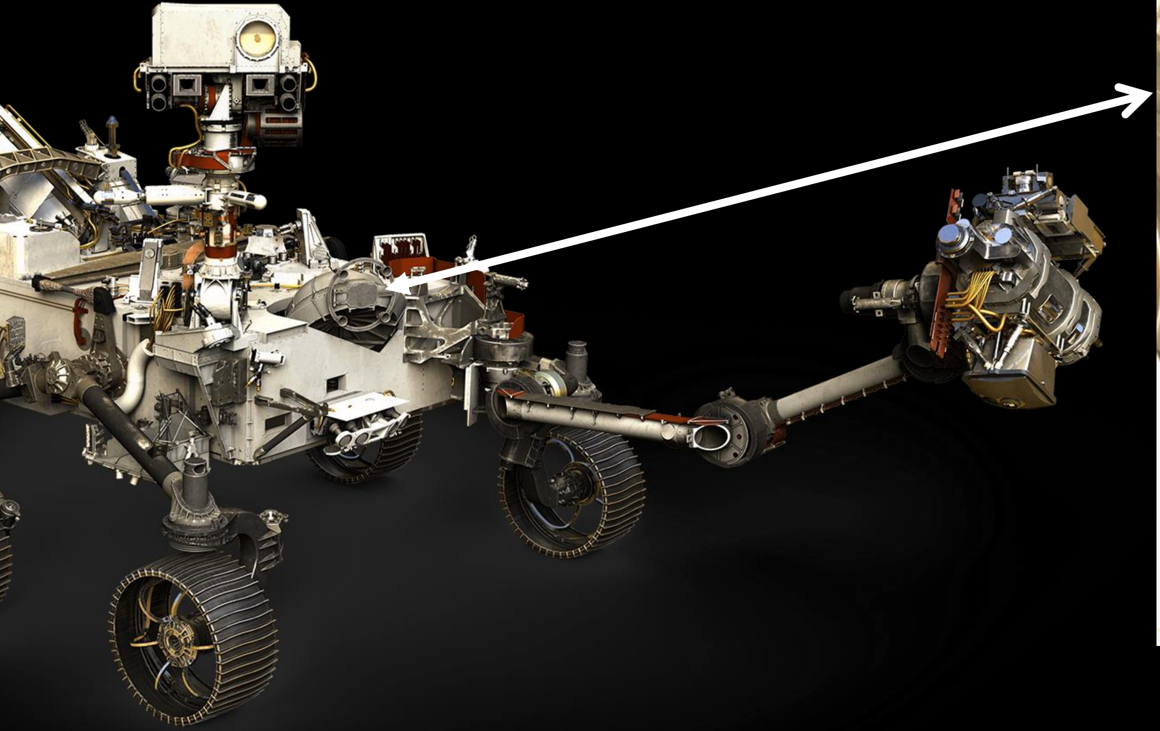
- Planning sol 339 on Mars
- The rover is healthy and all science instruments except MEDA are functioning with no significant issues
- 18 *Ingenuity* helicopter flights
- Total mission odometry: 2914 m
- Abrasions: 4
- Sample Tubes Sealed: 8
    - 3 pairs of rock cores
    - 1 atmospheric sample
    - 1 witness tube

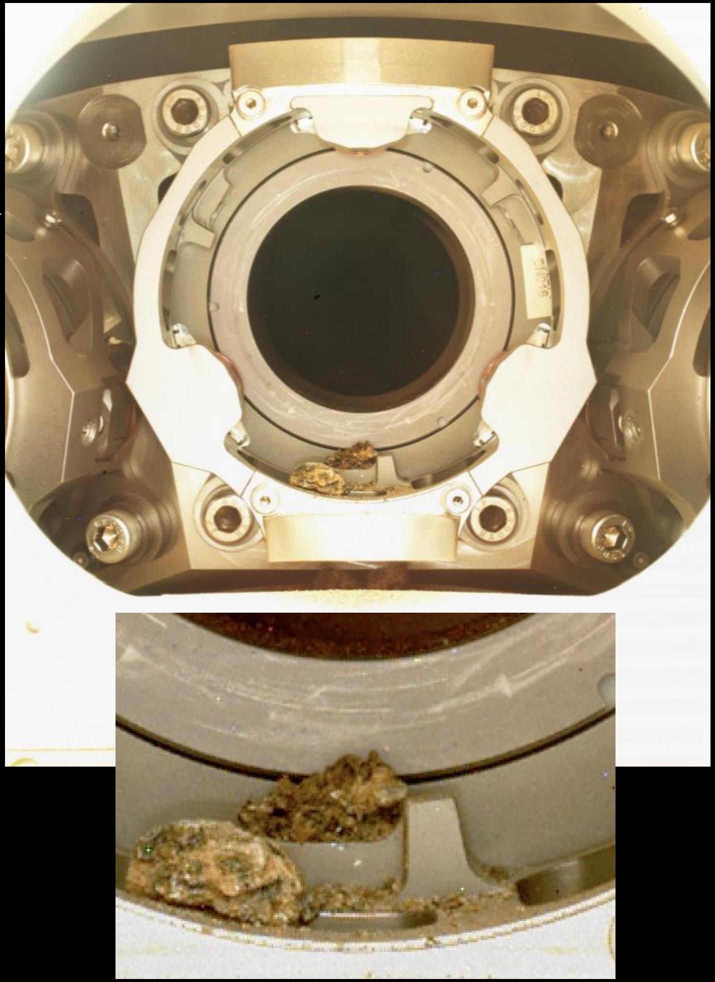

Ingenuity
Perseverance

Two PDS Deliveries Completed

Release	Acquisition (Sols)	Release to Public
1	0 - 89	20-Aug-21
2	90 - 179	22-Nov-21
3	180 - 299	22-Mar-22
4	300 - 419	22-Jul-22
5	420 - 539	21-Nov-22
6	540-639	7-Mar-23
7	640 - 669	6-Jul-23

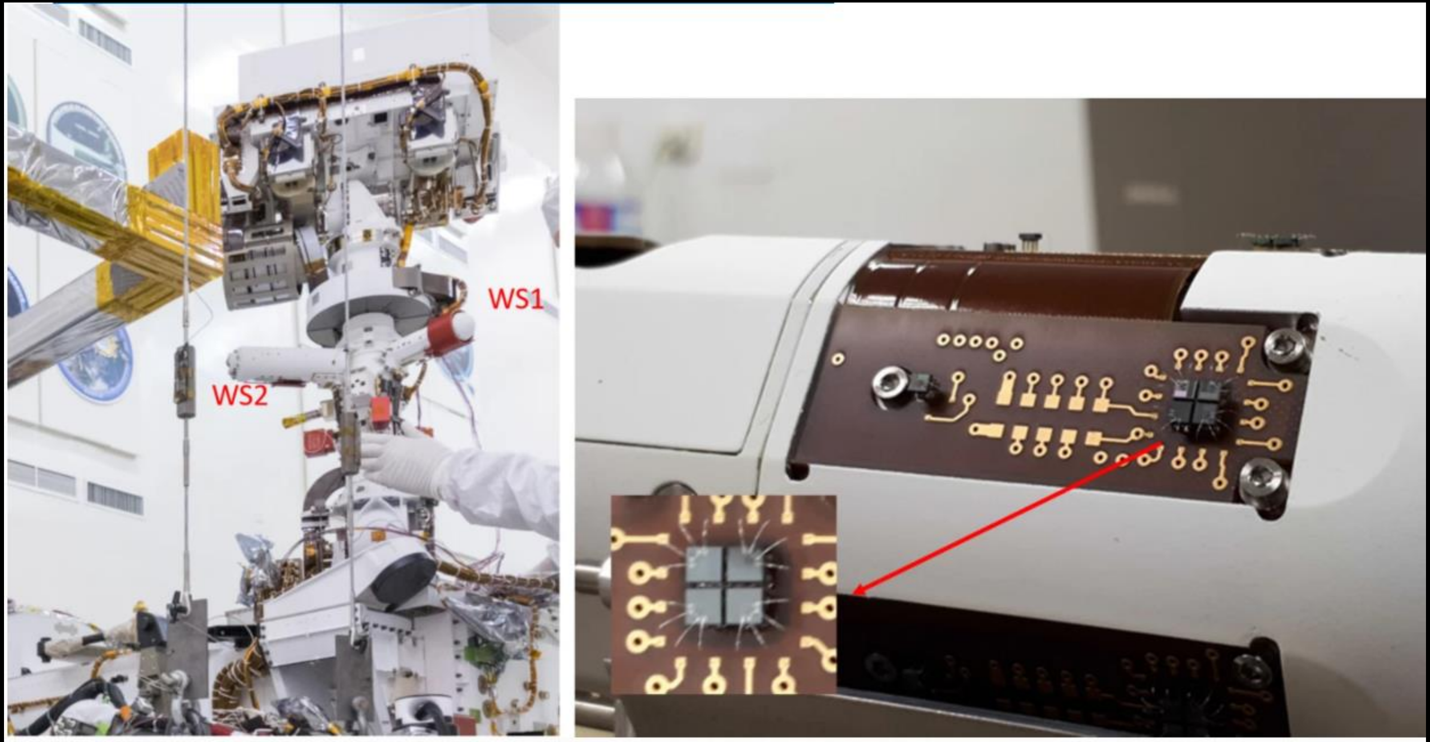
Nothing is ever easy (on Mars): Sol 306 "Pebble Anomaly"





RESOLVED

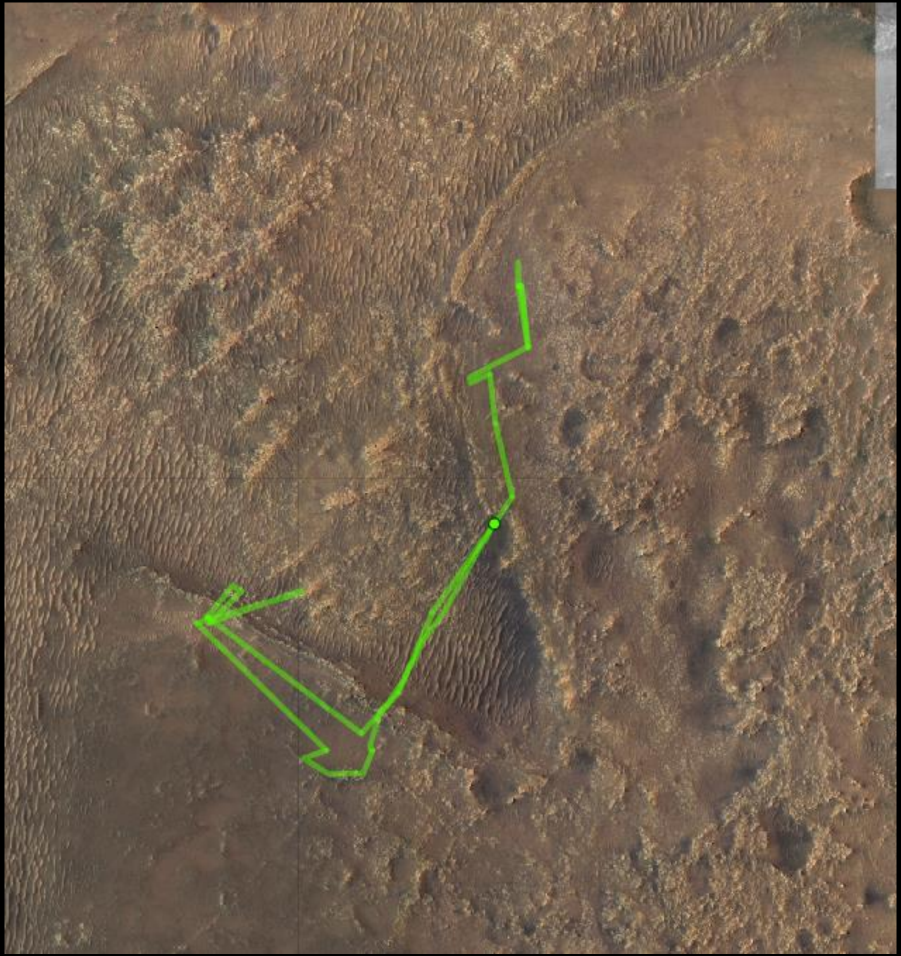
MEDA Wind Sensor Anomaly



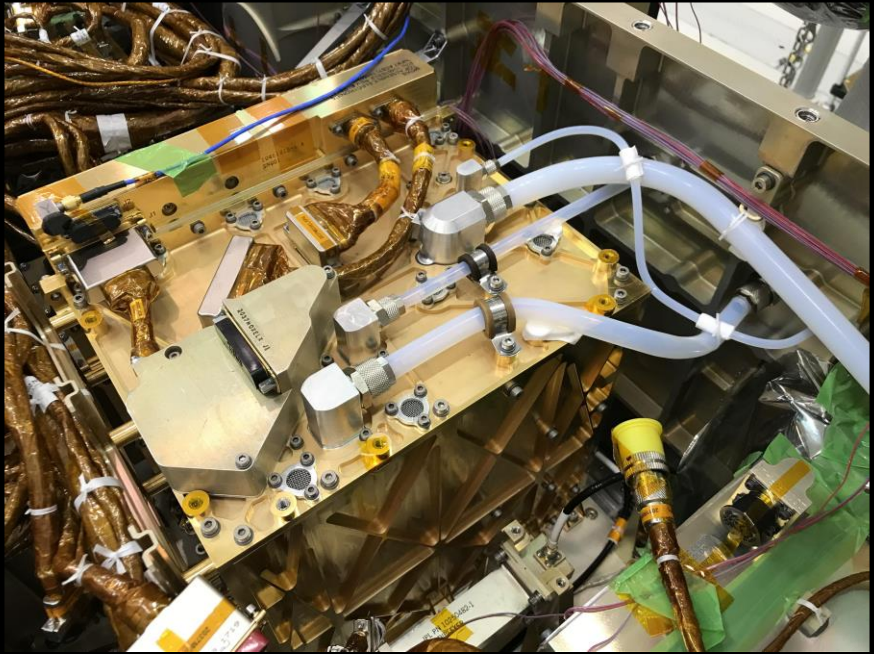
Several of the wind sensor transducers experienced faults
Assessment of the cause and implications of these faults is in progress

Ingenuity Flights

- 18 flights as of February 2
- heli now being staged ahead of rover in preparation for drive campaign to delta



MOXIE



- 8 Oxygen generation runs have been performed, all successfully
  - including worst-case low-pressure conditions
- O_2 purity is close to 100% when operated with that objective
- Degradation of the electrolytic stack is very low, many more runs are possible
- Upcoming runs will be more diagnostic in nature, refining understanding of the operational characteristics of the device

Sampling Details

How are Samples Selected?

Sample priority guided by community desires expressed in published documents, e.g., iMOST Report, as interpreted and applied to Jezero crater by the Mars 2020 Science Team

What "Field Notes" are being acquired?

Every sample (or paired sample set) is documented by a standardized set of observations that are executed following an optimized sol path of 10-15 sols duration. This Standardized Observation Protocol (STOP list) maximizes efficiency and consistency.

Included:

1) workspace imaging at multiple scales using (ZCAM, ECAM, SCAM RMI, WATSON)
2) workspace and abrasion-patch proximity and remote science (SHERLOC, PIXL, SCAM, ZCAM)
3) borehole and cuttings imaging and remote science (WATSON, SCAM, ZCAM)

Additional opportunistic science is also undertaken in association with sample collection.

Sampling Details

How are sample-related data recorded?

1) *Sample Dossier*

A digital "one stop shop" file that includes

1) Links to all STOP list observations for a given sample stored in PDS
2) Additional rover-related data associated with sampling, for example
    - Rover localization
    - Sampling event time history and coring operational and sensor details
    - Temperatures
    - Core length estimate and Cachecam images

Sampling Details

How are sample-related data recorded?

2) *Initial Reports*

A templatized narrative description of each sample, written by the science team within 3 weeks of collection

- Why the sample was collected
- How the sample fits in geologic context
- Description and initial interpretation of STOP list data
- Initial interpretation of the sample and its history
- Assessment of likely uses of the sample if returned to Earth

This document is preliminary, and is not revised after completion…

- Detailed interpretation developed over time will appear in peer reviewed publications

Example pages from *Roubion* Initial Report

INITIAL REPORT

M2020-164-2 *Roubion*

(no core recovered, atmospheric sample)

Sample Designation: M2020-164-2 Roubion

Date of Coring: 5-Aug-2021

Mars Time of Sample Core Sealing: 19:11:35 LMST, Sol 164, Ls 81.1

Latitude (N), Longitude (E), Elevation: 18.42769340, 77.45165066, -2584.96 m

Campaign: Crater Floor

Region of Interest: Séítah Thumb

Lithology: Fine- to medium-grained mafic and likely igneous rock, possibly basalt or microgabbro (alternatively, basaltic sandstone). Primary minerals are plagioclase and pyroxene, also possibly apatite and FeTi oxides. Weathering and/or aqueous alteration is indicated by pits and crevices in abraded surface and abundant secondary minerals including iron oxide (possibly hydrated), sulfates, perchlorate, and possibly phosphate and halite, usually in distinct patches

Estimated Volume Recovered: ~0 cm^3 (some ~10 µm sized particles). No core recovery

Coring Bit Number: 5

Core Orientation: hade = 3.43°; azimuth = 208.74°; core roll = 289.35°

Sample Serial Numbers: Tube SN233; Seal SN062; Ferrule SNxxx

ACA Temperature at Time of Sealing: 40°C

Estimated Rover-Ambient Pressure and Temperature at Time of Sealing: 749 Pa, 221 K

Estimated Amount of Martian Atmosphere Headspace Gas: 4.9×10^{-6} mol

Abrasion Patch Name and Depth: Guillaumes, 8 mm

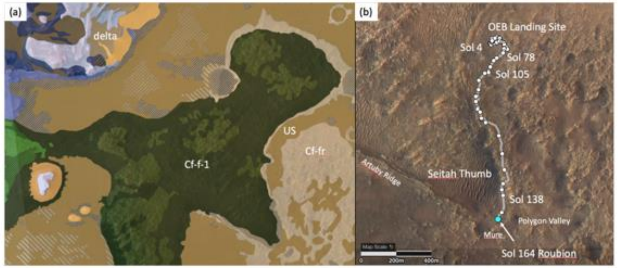
Anomalous Sample Behavior: Core disintegrated; no recovery

M2020-164-2 Roubion

Summary Description

Collection of Roubion, the first sample target of the Mars 2020 mission, was attempted in the Séítah Thumb region of the Jezero crater floor (**Figure 1**). Between Octavia E. Butler landing (OEB) and the sampling site, *Perseverance* traversed about 1 km southward over nearly continuous low-lying rocks typically forming meter-scale "paverstone" outcrops, with intervening regolith (**Figure 2**). In HiRISE orbital view, these rocks define a distinctive polygonal pattern, the lower lying of the several expressions of the Crater Floor Fractured Rough (Cf-fr) unit of Stack et al (2020).

Figure 1 | **Regional context. (a)** geologic map of Sun and Stack (2020) and units of Stack et al. 2020 and **(b)** HiRISE map with *Perseverance* traverse path leading to Roubion. Shown for reference are Octavia E. Buttler (OEB) landing site, Séítah Thumb area, Polygon Valley, Mure, and Artuby ridge.



Prior to landing, the Cf-fr unit was variously interpreted to be igneous (lava or volcanoclastic) or sedimentary (fluviolacustrine or aeolian) in origin. Although the stratigraphic context of the fractured floor, and indeed the lithology itself, were unknown at the time of sampling, the Cf-fr unit was selected for sample acquisition because it is areally extensive and because it includes the most heavily cratered terrain to which the rover has access within Jezero crater. As such, a returned sample of this unit was thought to have high science value for understanding the geologic setting and timing of crater floor units, and possibly for calibration of the Mars crater chronology function.

As evidenced by the common whaleback morphology and surface polish and fluting, this expression of Cf-fr has been eroded to just above ground level by aeolian abrasion (**Figure 2**). Despite abundant outcrop, little or no visual evidence of sedimentary structure, clasts, or crystals were seen in natural exposures of these rocks. Supercam data on multiple outcrops along the traverse indicate an altered (hydrated, iron-oxide-bearing) mafic rock with crystal size large enough to create spot-to-spot variability in composition (i.e., > few hundred µm scale). These low-lying Cf-fr rocks are fairly homogenous in appearance and composition along the entire traverse from OEB to Roubion.

The Roubion coring attempt, and its companion Guillaumes abraded patch, were undertaken on a low relief rock at the tip of the Séítah Thumb region selected largely to meet first-time sampling

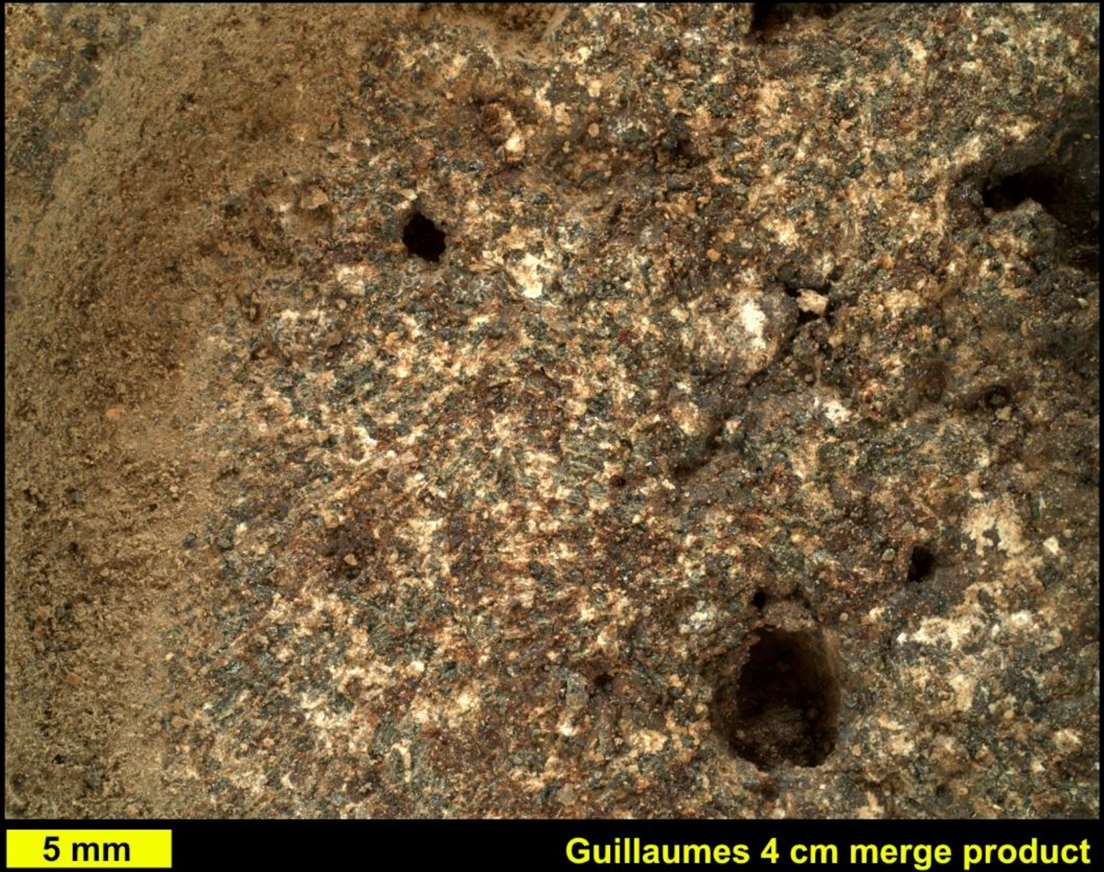
First few *Initial Reports* are running about 20 single-spaced pages, with 14 figures

First Science Campaign: Rocks of the Jezero Crater Floor

Proposed previously: fluvio-lacustrine or aeolian sediments, lava flows, impact melt sheet, volcanic ash deposits

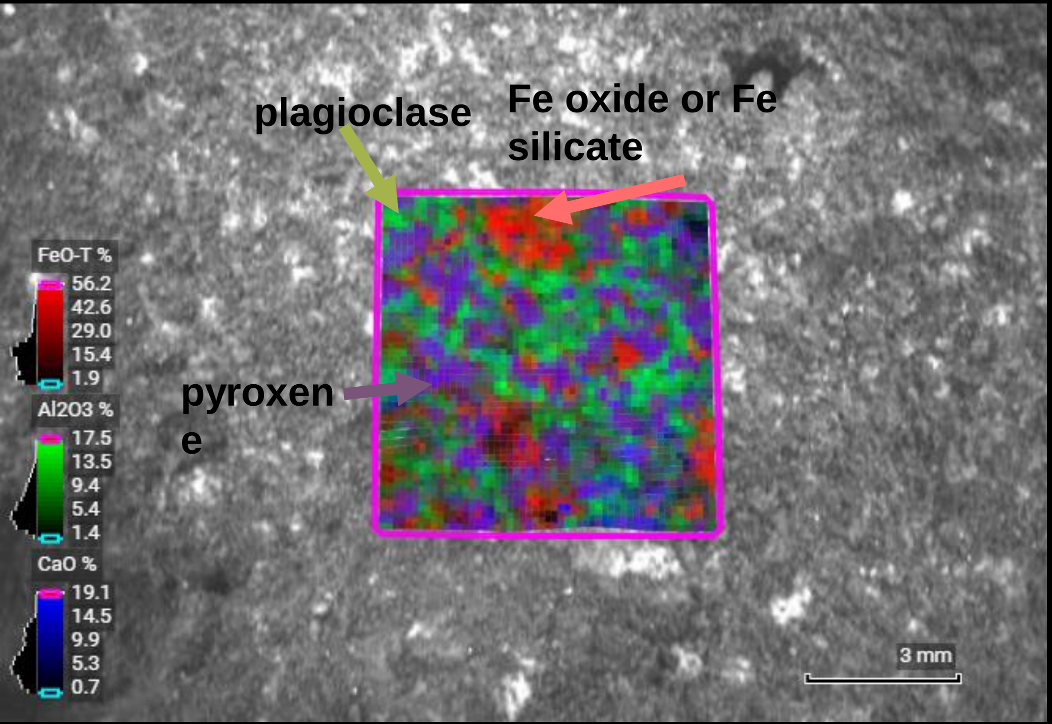
(Stack et al., 2020 and references

Máaz Formation Abrasion - *Guillaumes*



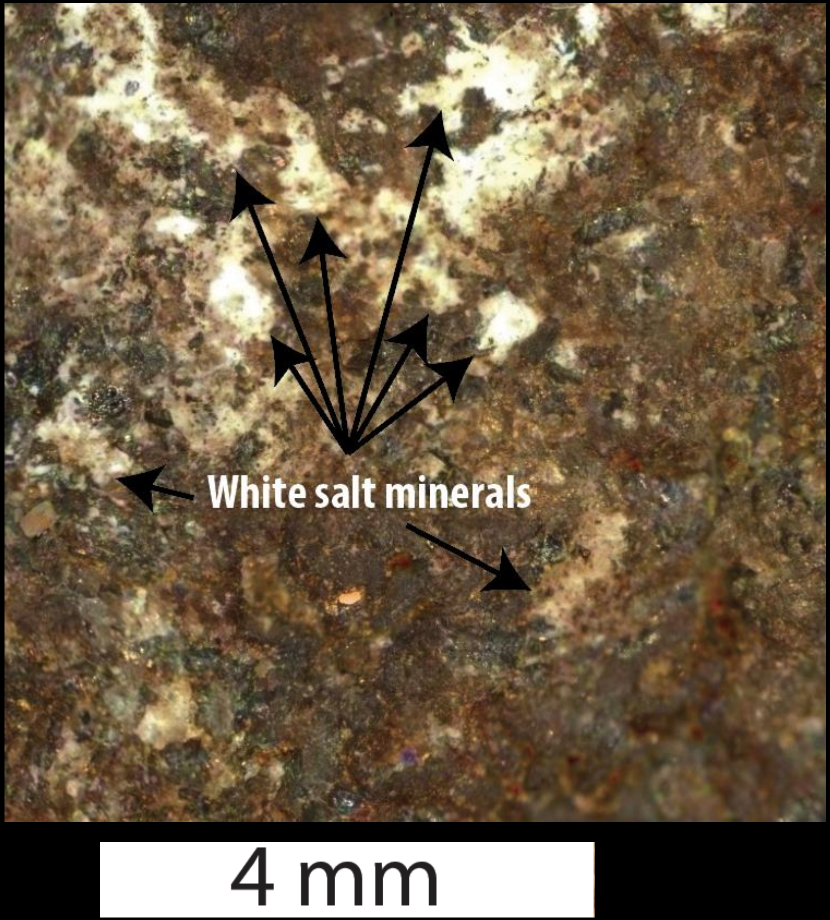
Interlocking grain texture, alteration

Máaz Formation Abrasion - *Guillaumes*



basaltic mineralogy and bulk composition
holocrystalline basalt or microgabbro

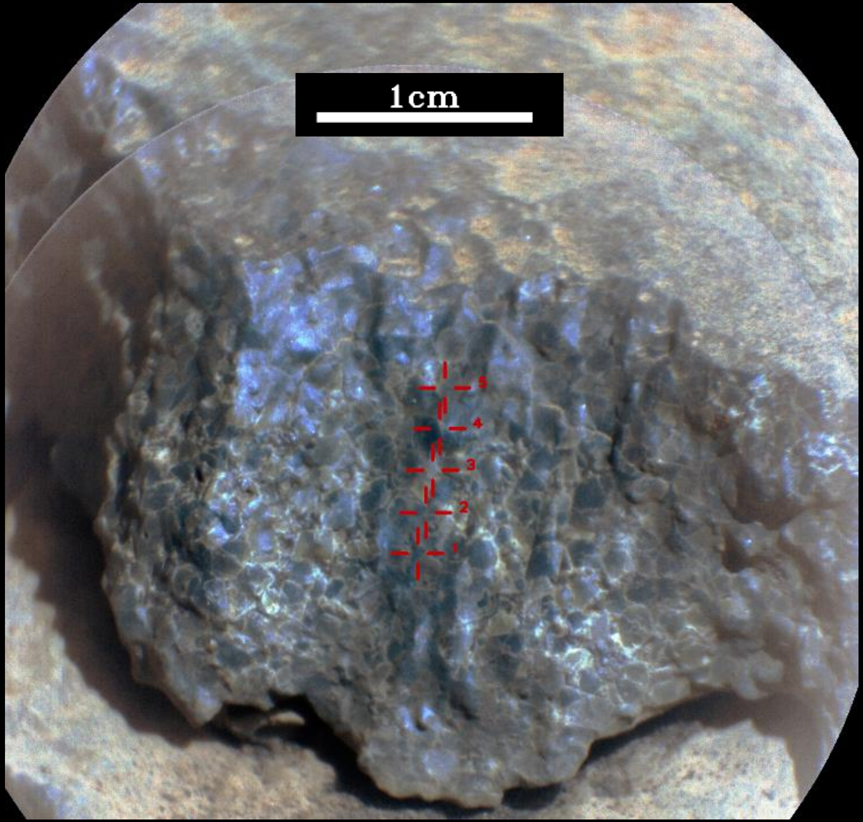
Aqueous alteration in *Guillaumes (Máaz* Formation*)*



From elemental composition and Raman spectroscopy:
Sulfate and perchlorate salts in white patches/vugs

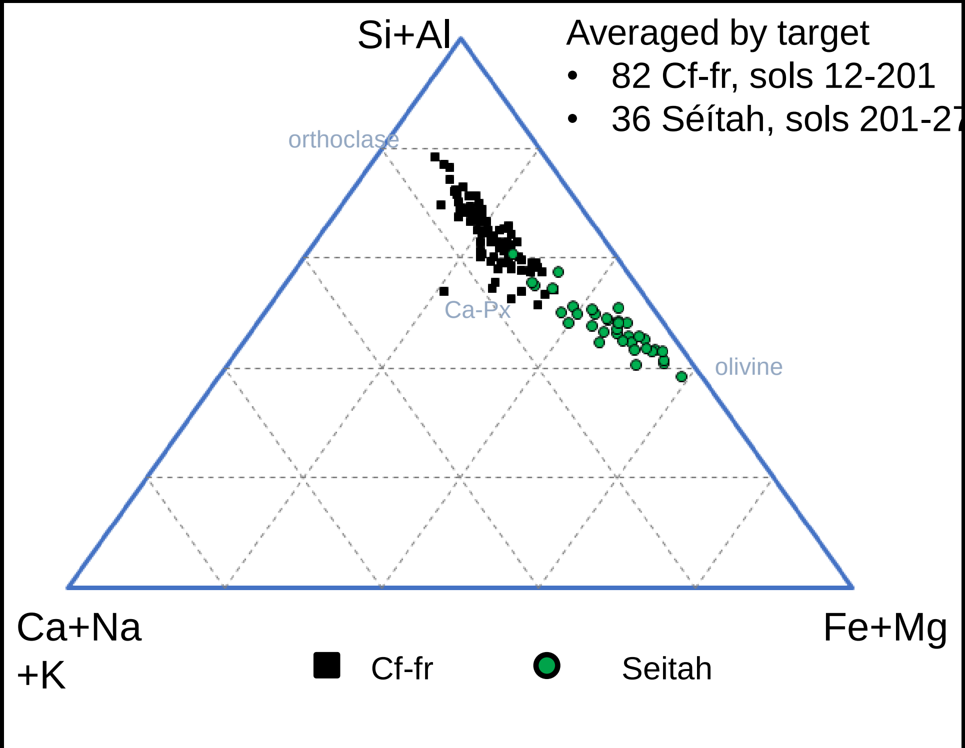
(similar features are seen in the *Séítah* formation)

Strong Distinctions Between *Máaz* and *Séítah*



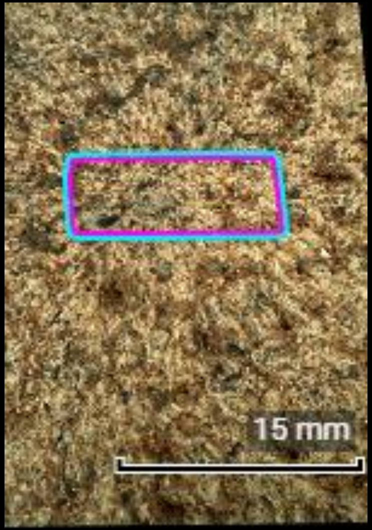
Supercam RMI

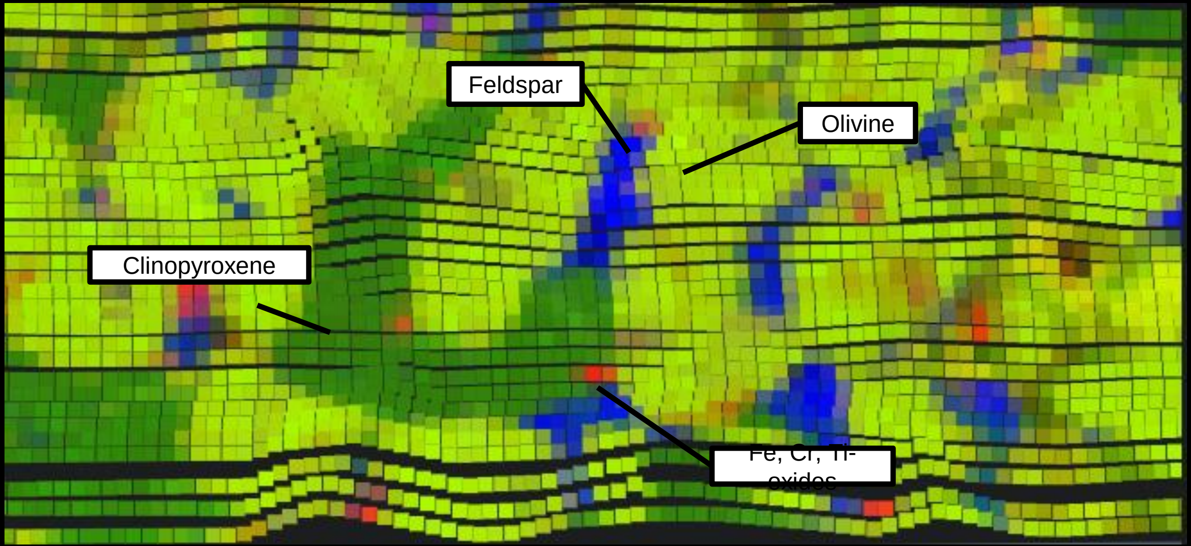
Supercam LIBS



Séítah: abundant olivine and high Mg, with densely packed angular to slightly rounded 2-3 mm-size crystals.

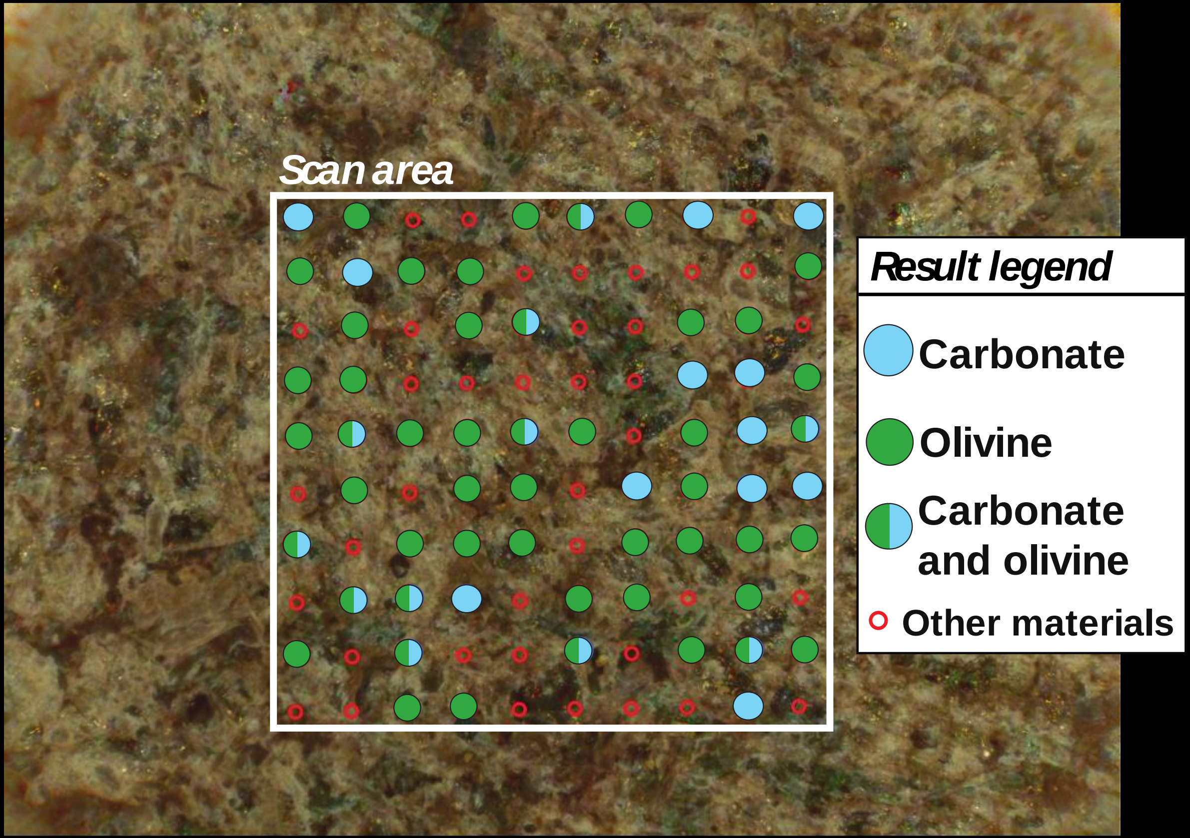
Séítah Formation *Dourbes* Abrasion Patch





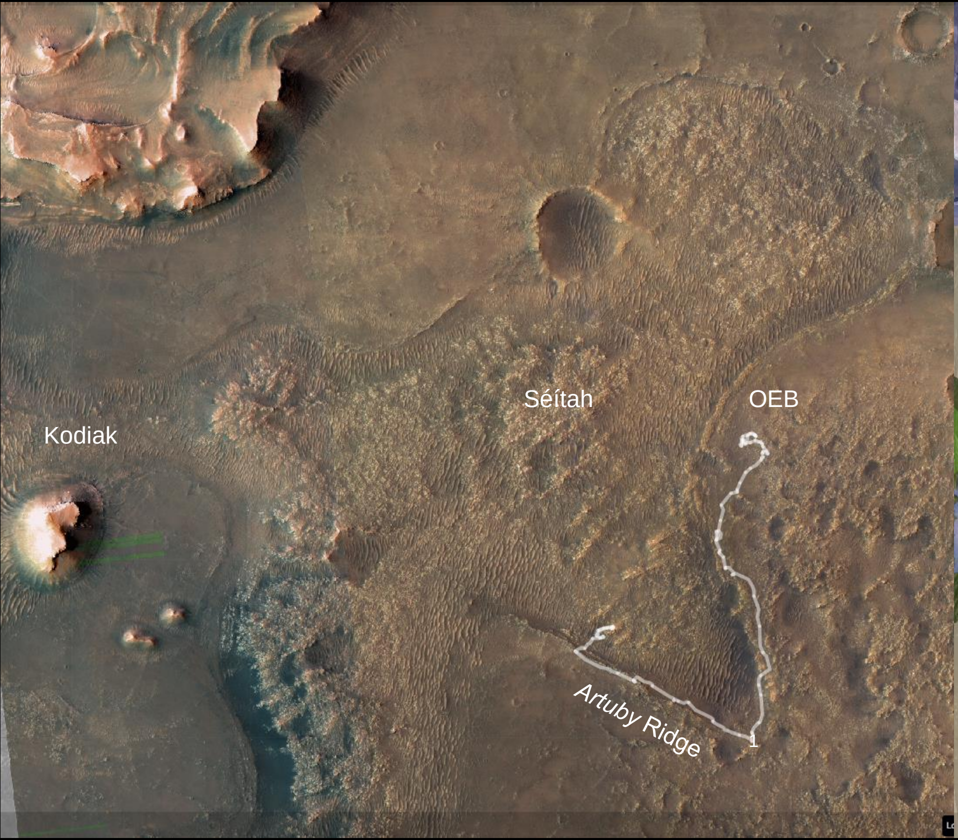
Poikilitic olivine cumulate -
differentiated igneous body (thick flow, melt sheet, lava lake, or intrusion)

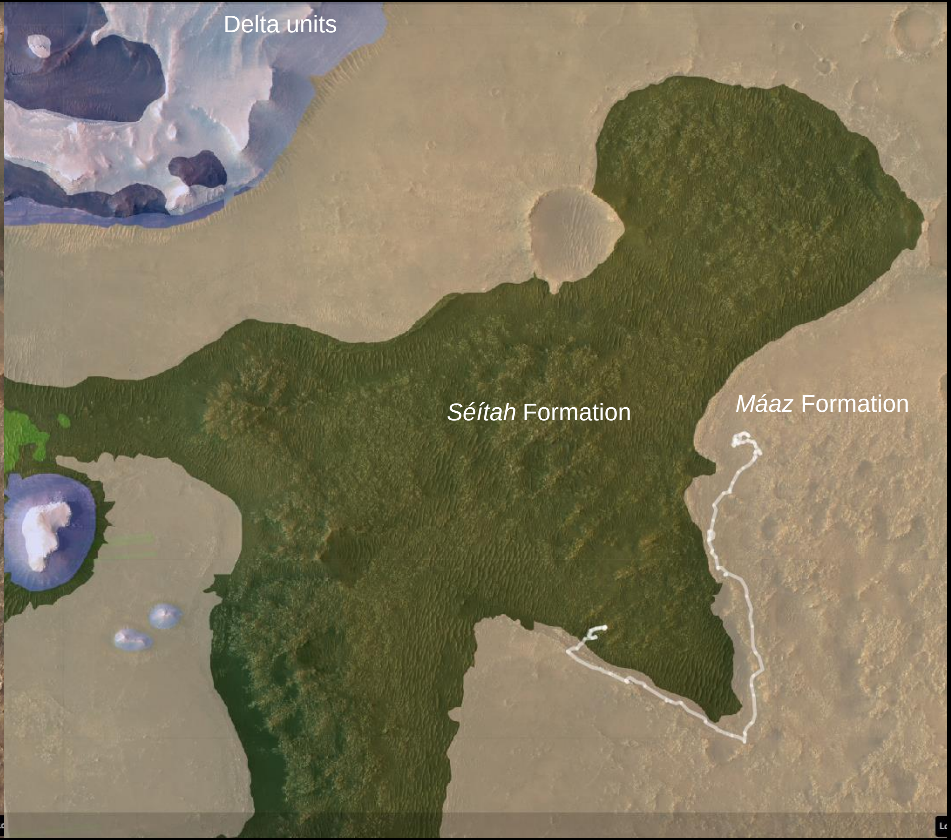
Raman Detection of Carbonate in *Séítah*



Possible in-situ carbonation of olivine by CO_2 rich water

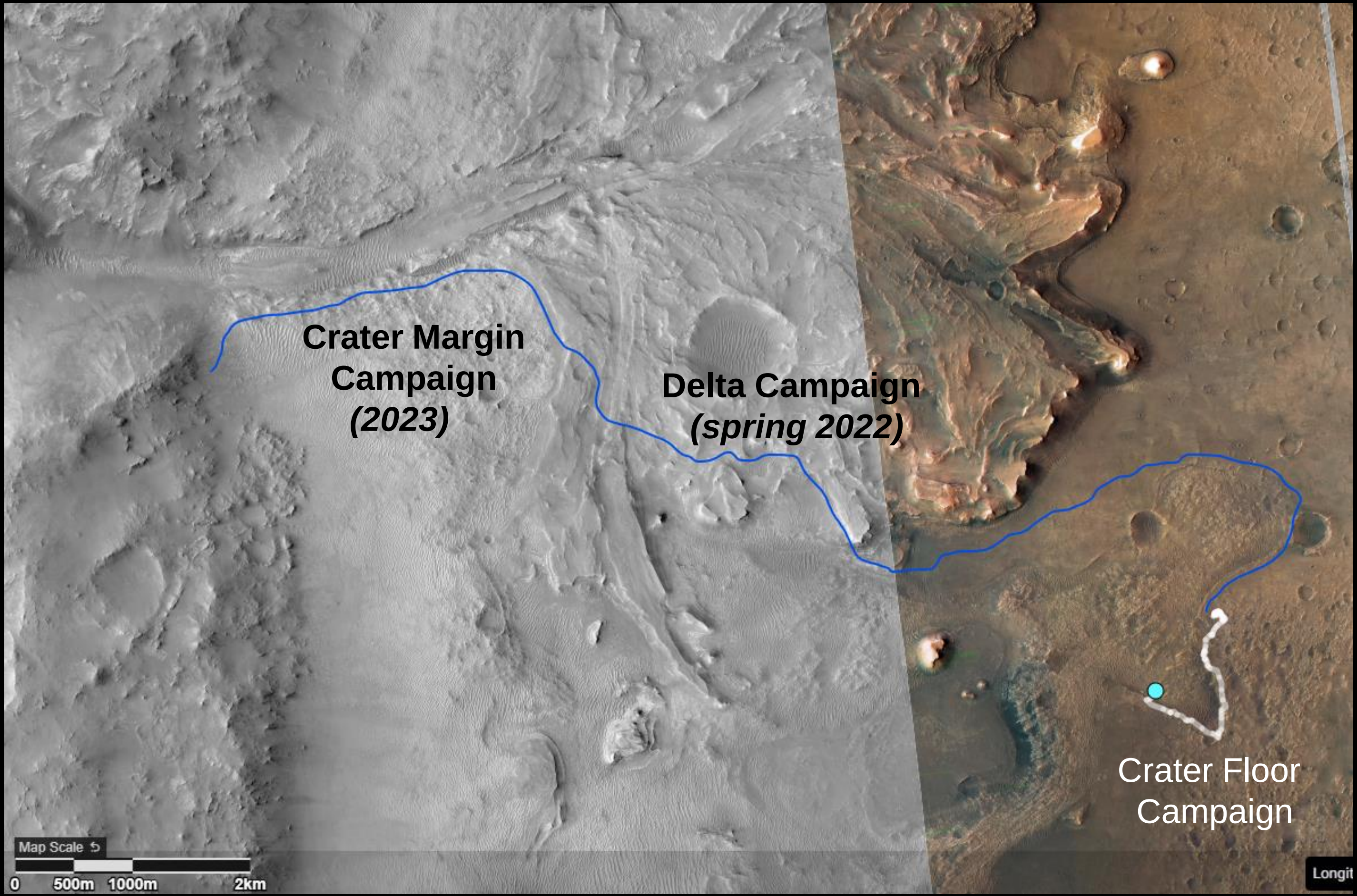
First Science Campaign: Rocks of the Jezero Crater Floor





Máaz and *Séítah* are both igneous formations
both have experienced multiple styles of aqueous alteration

Long-term Mars 2020 Plan



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